Distributed Generation Analysis Tool

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Background

- Joint project with SAIC and National Association of State Energy Officials.
- Tool's Purpose: Provide state energy offices with ability to analyze DG/CHP options as part of their resource planning.
- Tool provides economic and environmental impact analysis of any available DG technology (user-specified).
- Default technologies: fuel cell, microturbine, reciprocating engine.

Software Capabilities

- Life cycle cost analysis, including internal rate of return and simple payback.
- Hourly load profiles in addition to annual energy usage.
- Time-of-use, state average, or user-specified electricity rates.
- Analyze stand alone, CHP, peak shaving, and standby generation options.
- Creates library of rate schedules and technology options.

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DISTRIBUTED GENERATION ANALYSIS TOOL

NATIONAL ASSOCIATION OF STATE ENERGY OFFICIALS
NASEO
ENERGY'S WASHINGTON VOICE

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- Create / Define / Evaluate Scenarios
- Quick Start Instructions
- Print User Manual
- Contacts Information

Scenario Inputs

- Generators to be Evaluated
- Generator Usage Plan
- Financial Parameters
- Energy Rates

EXIT

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Create / Define / Evaluate Scenarios

Scenario Name: Large Commercial with 200 kW Generator

Generator to be Evaluated	200 kW PAFC
Generator Usage Plan	Large Commercial with 200 kW Generator
Financial Parameters	Commercial Financing

What Energy Rates do you want to use? (Pick 1 Electricity option and 1 Fuel option)

Electricity Options

- ○ Average Cost of Electricity plus Demand Charge Reduction
- ◉ Electricity Time of Use plus Demand Charge Reduction
- ○ Electricity Block Energy Rate Schedule plus Demand Charge Reduction

Fuel Options

- ○ Average Fuel Cost
- ◉ Fuel Block Rate Schedule

Electricity Time of Use	Schedule A
Demand Charge Schedule	Demand Charge Schedule A
Fuel Block Rate Schedule	Fuel Block Rate Schedule A
Miscellaneous Costs Schedule	None

Create New Scenario | Delete Scenario | Evaluate Scenario | How to use this form | Close

Record: 1 of 3

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Generators to be Evaluated

Generator to be Evaluated: 200 kW PAFC

Generation Source | Emissions | Installation and Maintenance Costs

Description of Generator:	200 kW PAFC
Full Load Generator Output (kW):	200
Electrical Efficiency:	36.0%
Full Load Fuel Input to Generator (Btu/hr):	1,895,556
Thermal Efficiency:	48.0%
Degradation percent per year (%):	2.00%
Max Usable Thermal Waste Heat at Full Load (Btu/hr):	909,867

Comments

Create New Generator | Delete Generator | Save Record | How to use this form | Close

Record: 2 of 4

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Generators to be Evaluated

Generator to be Evaluated: 200 kW PAFC

Generation Source | Emissions | Installation and Maintenance Costs

	Utility Emissions		Generator Emissions	Net Difference Generator - Utility
Sulfur Dioxide:	0.00000742	lb./kWh	0.00000350	-0.00000392
Nitrogen Oxide:	0.00000792	lb./kWh	0.00000300	-0.00000492
Carbon Dioxide:	0.00203323	lb./kWh	0.00053000	-0.00150323

Use the average rates for this state: New Mexico

Create New Generator | Delete Generator | Save Record | How to use this form | Close

Record: 2 of 4

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Generator Usage Plan	Large Commercial with 200 kW Generator
Generator to be Evaluated	200 kW PAFC
Day Type	Summer Weekday
Facility	ACME Industries

Hour	Output of Generator (kWh)	Electricity Facility will use (kWh)	Fuel Input to Generator (Btu/hr)	Waste Heat Available from Generator (Btu/hr)	Waste Heat Used by Site (Btu/hr)	Displaced Boiler Fuel (Btu/hr)	
1	200.00	352.60	1,896,000	900,100	0		Clone Previous Hour
2	200.00	343.70	1,896,000	900,100	0	0	Clone Previous Hour
3	200.00	342.90	1,896,000	900,100	0	0	Clone Previous Hour
4	200.00	357.60	1,896,000	900,100	0	0	Clone Previous Hour
5	200.00	394.00	1,896,000	900,100	0	0	Clone Previous Hour
6	200.00	446.30	1,896,000	900,100	0	0	Clone Previous Hour
7	200.00	487.50	1,896,000	900,100	225,021	300,028	Clone Previous Hour
8	200.00	521.50	1,896,000	900,100	225,021	300,028	Clone Previous Hour

Recalculate Displaced Boiler Fuel | Save Record | How to use this form | Close

Record: 1 of 24

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EVALUATE SCENARIO

Daily Operating Summary

Annual Operating Summary

Year by Year Financial Analysis

Annual Emissions Summary

How to use this form

Close

YEAR BY YEAR FINANCIAL ANAYSIS

Scenario Name **Large Commercial with 200 kW Generator**

Generator to be Evaluated 200 kW PAFC

Generator Usage Plan Large Commercial with 200 kW Generator

Energy Rate Options Chosen

Electricity Options

O **Avera**ge Cost of Electricity plus Demand Charge Reduction

O Electricity Time of Use plus Demand Charge Reduction

O Electricity Block Energy Rate Schedule plus Demand Charge

Fuel Options

O Average Fuel Cost

Fuel Block Rate Schedule

Electricity Time of Use Schedule	Schedule A
Demand Charge Schedule	Demand Charge Schedule A
Fuel Block Rate Schedule	Fuel Block Rate Schedule A

	Cost/Value
Installed Cost of Generator:	$1,000,000
Maintenance Expenses ($/kWh): `	0.018
Electricity Generated – Annual Total:	$181,633
Demand Reduction – Annual Total:	$97,690
Electricity Sold Back to Grid – Annual:	($36,498)
MBtu Generator Fuel Used – Annual:	16,609
MBtu Boiler Fuel Saved – Annual:	2,981
Cost of Net Fuel Used – Annual Total:	$38,515
Misc. Annual Costs – Electricity:	$0
Misc. Annual Costs – Fuel:	$0

Financial Inputs

Real Cost of Equity	9.00%	**Loan Term**	10 years
Real Cost of Debt	9.50%	**Number of Years to be Evaluated**	20 years
Percentage of Debt	0.00%	**Depreciation Period**	10 years
Weighted Real Cost of Capital	9.00%		

Tax Rate	20.00% per year
Real Escalation Rate for Cost of Electricity	2.00% per year
Real Escalation Rate For Cost of Fuel	2.00% per year
Inflation Rate	0.00% per year

Simple Payback (Years)	6.15
Internal Rate of Return	**14.60%**

CASH FLOW AND FINANCIAL ANALYSIS

Operations	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Combined Electricity Savings		279,322	284,909	290,607	296,419	302,347	308,394	314,562	320,854	327,271	333,816
Savings From Generated Electricity		181,633	185,265	188,971	192,750	196,605	200,537	204,548	208,639	212,812	217,068
Savings From Demand Reduction		97,690	99,643	101,636	103,669	105,742	107,857	110,014	112,215	114,459	116,748
Maintenance Expenses		**62,596**	**62,596**	**62,596**	**62,596**	**262,596**	**62,596**	**62,596**	**62,596**	**62,596**	**262,596**
Net Fuel Costs		38,515	40,263	41,068	41,889	41,690	43,582	44,453	45,342	46,249	46,029
Miscellaneous Costs		0	0	0	0	0	0	0	0	0	0
Cash Flow From Operations		**178,211**	**182,050**	**186,943**	**191,934**	**-1,939**	**202,217**	**207,513**	**212,915**	**218,426**	**25,191**
Total Project											
Principal Repayments		0	0	0	0	0	0	0	0	0	0
Interest		0	0	0	0	0	0	0	0	0	0
Before Tax Cash Flow	-1,000,00	178,211	182,050	186,943	191,934	-1,939	202,217	207,513	212,915	218,426	25,191
Depreciation		100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Taxes		15,642	16,410	17,389	18,387	-20,388	20,443	21,503	22,583	23,685	-14,962
After Tax Cash Flow	-1,000,00	162,569	165,640	169,555	173,547	18,449	181,774	186,011	190,332	194,740	40,153
Cumulative After Tax Cash Flow	-1,000,00	-837,431	-671,791	-502,236	-328,689	-310,240	-128,466	57,544	247,876	442,617	482,770
Present Value of After Tax Cash Flow	-1,000,00	149,146	139,416	130,927	122,945	11,991	108,386	101,754	95,521	89,664	16,961
Cumulative Present Value	**-1,000,000**	**-850,854**	**-711,438**	**-580,511**	**-457,566**	**-445,575**	**-337,189**	**-235,435**	**-139,914**	**-50,250**	**-33,289**

Operations	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Combined Electricity Savings	340,492	347,302	354,248	361,333	368,560	375,931	383,450	391,119	398,941	406,920
Savings From Generated Electricity	221,409	225,837	230,354	234,961	239,661	244,454	249,343	254,330	259,416	264,605
Savings From Demand Reduction	119,083	121,465	123,894	126,372	128,899	131,477	**Fuel** 134,107	136,789	139,525	142,315
Maintenance Expenses	62,596	62,596	62,596	262,596	62,596	62,596	62,596	62,596	262,596	62,596
Net Fuel Costs	48,118	49,080	50,062	49,824	52,084	53,126	54,188	**Rate** 55,272	55,009	57,505
Miscellaneous Costs	0	0	0	0	0	0	0	0	0	0
Cash Flow From Operations	**229,779**	**235,626**	**241,591**	**48,914**	**253,880**	**260,209**	**266,666**	**273,251**	**81,336**	**286,819**
Total Project										
Principal Repayments	0	0	0	0	0	0	0	0	0	0
Interest	0	0	0	0	0	0	0	0	0	0
Before Tax Cash Flow	229,779	235,626	241,591	48,914	253,880	260,209	266,666	273,251	81,336	286,819
Depreciation	0	0	0	0	0	0	0	0	0	0
Taxes	45,956	47,125	48,318	9,783	50,776	52,042	53,333	54,650	16,267	57,364
After Tax Cash Flow	**183,823**	**188,501**	**193,273**	**39,131**	**203,104**	**208,168**	**213,332**	**218,601**	**65,069**	**229,455**
Cumulative After Tax Cash Flow	666,593	855,094	1,048,367	1,087,498	1,290,602	1,498,769	1,712,102	1,930,702	1,995,771	2,225,226
Present Value of After Tax Cash Flow	71,237	67,019	63,041	11,710	55,760	52,431	49,295	46,342	12,655	40,942
Cumulative Present Value	**37,949**	**104,967**	**168,009**	**179,718**	**235,478**	**287,909**	**337,205**	**383,547**	**396,202**	**437,144**

ANNUAL EMISSIONS SUMMARY

Scenario Name Large Commercial with 200 kW Generator

Generator Usage Plan Large Commercial with 200 kW Generator

Facility: ACME Industries

	Day Type	Output of Generator (kWh)	Facility Electric Load Profile (kWh)	Fuel Input to Generator (MBtu)	Max Usable Thermal Waste Heat (MBtu)	Waste Heat we can use (MBtu)	Displaced Boiler Fuel (MBtu)
129	Summer Weekday	619,200	1,438,789	5,870	2,787	517	689
52	Summer Weekend	249,600	524,898	2,366	1,123	161	215
3	Summer Holiday	14,400	23,053	137	65	2	3
123	Winter Weekday	590,400	1,174,982	5,597	2,657	1,234	1,646
52	Winter Weekend	249,600	363,319	2,366	1,123	299	399
6	Winter Holiday	28,800	51,869	273	130	22	29
	Annual Totals	1,752,000	3,576,910	16,609	7,885	2,236	2,981

Generator Emissions Summary

Generator to be Evaluated 200 kW PAFC

Description 200 kW PAFC

	Utility Emissions		Generator Emissions	Net Difference Generator - Utility
Sulfur Dioxide:	26.54	**lbs.**	12.52	-14.02
Nitrogen Oxide:	28.31	**lbs.**	10.73	-17.58
Carbon Dioxide:	7,272.67	**lbs.**	1,895.76	-5,376.90

Summary

- Distributed Generation Analysis Tool ready for beta testing in two weeks.

- Contact David Terry at NASEO to participate in beta testing - Telephone: (703) 299-8800, extension 12.

- Technical support during beta testing contact:

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